

Combining a Patient Registry with a Disease Knowledge Base: The University of Illinois Intelligent Stroke Registry

Chiang S. Jao, Ph.D., Daniel B. Hier, M.D. and Steven U. Brint, M.D.
Department of Neurology, University of Illinois at Chicago, Chicago, IL

ABSTRACT

Computer-based databases are commonly used to implement disease-specific patient registries. Traditional disease-specific patient registries record demographics, laboratory data, clinical diagnosis, treatment, patient course and patient outcome for a large cohort of patients with a single disease. The most common neurological illness requiring hospitalization is stroke. Many hospitals maintain computerized stroke patient registries. Patient data is usually acquired through a series of standardized forms and then manually inputted into a database through a series of data entry screens. This process is usually divorced from the process of neurological consultation and often reflects a duplication of effort. Few neurological consultations utilize expert systems. Medical expert systems provide an opportunity to assist physicians with both diagnosis and selection of therapy. Furthermore, medical expert systems can help improve the educational value of a consultation.

In constructing our Intelligent Stroke Registry (ISR), we addressed two design issues. The first was simplification of the user interface using hypermedia methods. The second was speeding access to the disease-specific knowledge base utilizing contextual indexing methods. Hypermedia simplifies the screen layout of traditional medical expert systems by reducing the number of panes browsed by the user. Medical expert systems require complex supporting knowledge bases. Access to these knowledge bases can be simplified by the use of contextual data indexing method. The contextual indexing method improves the performance of data retrieval significantly when the size of knowledge bases grows. KnowledgePro® for Windows™ is an expert system shell used to achieve these design goals.

There are three major components of the Intelligent Stroke Registry: (1) The patient registry: each patient is entered into a flat file database in the dBase-IV format. (2) A disease-specific knowledge base relevant to stroke: it consists of text relevant to

stroke, bibliographic references relevant to stroke, as well as medical "rules" relevant to the diagnosis, treatment, and outcome of stroke. (3) The neurological consultation: all inputted items acquired during patient registration are combined with items from the disease-specific knowledge base to produce a formatted neurological consultation. By comparing the physician's opinion on etiological diagnosis to the rule-based computation on stroke classes as well as stroke mechanisms, the Intelligent Stroke Registry can easily analyze the stroke-related disease and provide an automated care plan to attending physicians. Two additional modules are added to the Intelligent Stroke Registry for educational purposes: the Vascular Anatomy Teaching Tool (VATT) and the Symptom Analyzer (SA). The Vascular Anatomy Teaching Tool applies hypertext and hypergraphical features to outline the relationships among selected arterial branches, their supplied arteries, their supplying collaterals as well as territories, and territory-related symptoms. The Symptom Analyzer is used to locate all possibly common sites in groups infected by selected symptoms.

The Intelligent Stroke Registry combines an automated stroke consultation, a stroke registry, and an expert system. Hypermedia and expert systems have been combined to build a knowledge-based tool for a clinical setting. Hypermedia enhances the user interface by simplifying screen layout. Expert system features provide automated access to an extensive disease-specific knowledge base. Contextual data indexing provides a fast and simple method for knowledge representation and acquisition. The physician can archive patient data easily for future retrieval. A legible consultation summarizes patient data, physician commentary, and accessed information from the knowledge base. Our Stroke Registry with expert system features is a valuable educational tool and presages the appearance of next-generation expert systems that will improve both the quality and cost-effectiveness of stroke care.